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Arachnids in Mediterranean protected areas of Egypt

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Abstract

This is a preliminary study of four orders of class Arachnida, i.e. Araneida, Pseudoscorpionida, Scorpionida and Solpugida, in four Egyptian protected areas on the Mediterranean Sea, i.e. Omayed, Burullus, Zaranik and Ahrash [Rafah] protectorates. Scattered collecting sites were randomly chosen in every protectorate. Several taxa were identified, mostly of spiders (27 species and 36 genera of 27 families), followed by six scorpion species and a minority of pseudoscorpions and sun-spiders. There were many unidentifiable species and genera. The studied areas need a seasonal survey and more detailed studies. An ethological observation on the cannibalism in the scorpion *Androctonus australis* is included.

Keywords: Arachnida, Spiders, Scorpions, Pseudoscorpions, Sun-spiders, Protected areas, Mediterranean, Egypt.

Introduction

Most studies in protected areas in the world are devoted to vertebrate animals. Invertebrate animals are mostly neglected, in spite of their huge number of species/individuals and their great influence on the surrounding habitats. Arachnids, especially spiders, constitute a considerable ratio of invertebrates with great ecological importance. They have a very important role, as predators, in biological balance.

A preliminary study of arachnids in four protected areas on the Mediterranean sea had been achieved during 2000-2004. It is not a survey of every living species in these areas. The recorded species may be the most common species. This study was preceded by a similar study on protected areas on Aqaba gulf (El-Hennawy, 2003).

Identification of spiders is very difficult in a poorly studied arachno-fauna as in Egypt. Juvenile specimens are useless and unidentifiable, even to genus level. In few cases, individual juvenile spiders were kept alive until they reached maturity and became identifiable. The brief description of each of the four protectorates is adopted from MSEA (2001) and Rashid (2002).



Map 1. Mediterranean protected areas of Egypt. 1 = Omayed, 2 = Burullus, 3 = Zaranik, 4 = Ahrash [in Rafah].

Methods

A preliminary survey of spiders, scorpions, pseudoscorpions and sun-spiders had been achieved in four protected areas on the Mediterranean Sea (El-Omayed, El-Burullus, El-Zaranik and El-Ahrash [Rafah] Protectorates) during 2000-2004 (Map 1). The four areas were unequally visited. El-Omayed was visited twice; 15-18 August 2000 and 8-11 October 2000. El-Burullus was visited once; 3-8 September 2000. El-Zaranik was visited ten times; 9-12 August 2000, 2-5 October 2000, 5-8 November 2000, 3-6 July 2001, 24-27 October 2001, 11 November 2001, 13-16 September 2002, 4-7 May 2003, 23-26 April 2004, and 1-4 June 2004. El-Ahrash was visited twice; 7 November 2000 and 25 October 2001.

Different sites were selected and surveyed as scattered places in each protectorate. The aim was to discover different areas and habitats and to know what species are there existing. Those sites are mentioned with their longitudes and latitudes, and sometimes the altitude, in the 'Results' section before the tables of collected spider specimens.

The collecting methods were: 1. Collecting with the hands, 2. Pitfall trapping, 3. Light attracting, 4. Beating net, 5. Sweeping net, and 6. Ultra-Violet light collecting for scorpions. The identification of specimens was executed in the light of the available taxonomical knowledge, taking in consideration that the group of Arachnida is poorly studied in this geographical area. Indeed, it is the first study of arachnids in the Mediterranean protected areas of Egypt.

Results

Results are here arranged within smaller sections, each deal with the spiders, scorpions, pseudoscorpions and sun-spiders of one protected area. A list of identified spider species, alphabetically arranged, is presented at the 'Discussion' section with authors and dates to avoid mentioning them inside the tables.

A. Omayed protectorate

El-Omayed was declared as protected area by the Prime Ministerial Decree No. 671 for 1986, adjusted by Prime Ministerial Decree No. 90 for 1996. Its area is about 700 km². Type: Desert area and vital peripheral.

The Omayed protected area encompasses a very small segment of the Mediterranean coastal desert of Egypt, a distinct habitat type and one of the richest terrestrial biological diversity in Egypt. This is the only protected area encompassing this habitat type in Egypt, and includes biological components not found in other protected

areas in the country. The area has a high floral diversity and a good vegetation cover. There are around 170 species of wild plants growing in different ecosystems, on sand dunes and among inland hills. About 70 species of them can be used for medical and therapeutical purposes like squall, wormwood, plantain and sorrel. There are also 60 species that can be used for different purposes including fuel like buckthorn and boxthorn, as source of oils like Ghoul Henna, for landscaping like Dirs Eshshayib, for manufacturing ropes and roofs like reed, and for pasturing like Tafwa. There are about 40 species of plants that have important environmental roles such as detaining sand and building new layers. A very rich fauna is also present, including several endangered, endemic and restricted range species. Important faunal elements include the endangered Four-toed Jerboa *Allactaga tetradactyla*, the endemic Pallid Gerbil *Gerbillus perpallidus*. There are also 14 species of wild birds recorded from the area. The endangered Egyptian Tortoise *Testudo kleinmanni* is known from the region.

Collecting Sites:

1. Visitors Centre: 30°44'38"N 29°09'59"E Alt. 110m
2. North west of Core Zone: 30°46'06"N 29°11'41"E Alt. 31m
3. West of Core Zone (100 m south of site [2])
4. El-Gabbasat 1: 30°44'52"N 29°11'25"E Alt. 90m
5. El-Gabbasat 2: 30°44'50"N 29°11'25"E Alt. 90m
6. Southern border of the Protectorate: 30°44'02"N 29°11'00"E Alt. 103m
7. Dry low area with small adjacent sand dunes: 30°48'29"N 29°11'32"E Alt. 16m
8. Khashm El-A'eish west of Visitors Centre: 30°44'18"N 29°08'24"E Alt. 90m
9. Northern Slope of Khashm El-A'eish
10. Eastern border of the Protectorate: 30°46'20"N 29°17'16"E - 30°45'95"N 29°17'24"E Alt. 53m
11. Military watching point upon Khashm El-A'eish: 30°45'32"N 29°12'22"E

I. Order Araneida

Spiders of fourteen families were collected from the eleven studied sites. The identification of the collected specimens with their numbers, sites and months of collecting are included in Table 1.

Table 1: Spiders collected from Omayed protectorate.

* = Specimens collected by other colleagues on February 1998.

Family	Species	Specimens	Sites	Months
Agelenidae	<i>Benoitia lepida</i>	1♂, 6♀, 5j	2,7,9	Aug, Oct
Clubionidae	<i>Clubiona</i> ? sp.	1♂	1	Oct
Dysderidae	<i>Dysdera</i> sp. *	1♂	9	Feb
Filistatidae	? sp. *	1♀	9	Feb
Gnaphosidae	<i>Micaria</i> sp.	1♀	10	Oct
	<i>Poecilochroa senilis</i>	2♂	2	Aug
	<i>Pterotricha schaefferi</i>	1♂, 5♀, 1s♂, 12j	1-5,7,8,10,11	Aug, Oct
	<i>Zelotes</i> ? sp.	1s♀, 4j	3,8-10	Oct
	? sp. (~ 5 spp.)	9j	3,5,8,10	Aug, Oct
Lycosidae	? sp. (3 spp.)	1♂, 1♀, 9j	1-5,8,10	Aug, Oct
Oecobiidae	<i>Oecobius</i> sp.	1j	1	Aug
Oxyopidae	<i>Oxyopes</i> sp.	1♂, 8♀	2,4	Aug
Philodromidae	<i>Thanatus</i> sp.	1j	10	Oct

Salticidae	<i>Menemerus animatus</i>	1♂	1	Aug
	<i>Mogrus fulvovittatus</i>	1♀	3	Aug
	? sp. (~ 4 spp.)	9j	1,5,6,8,11	Aug, Oct
Sicariidae	<i>Loxosceles</i> sp.	9j	5-8,10	Aug, Oct
Theridiidae	<i>Steatoda ephippiata</i>	1♀	5	Aug
Thomisidae	<i>Thomisus</i> sp.	3j	3,4,6	Aug, Oct
	<i>Xysticus</i> sp.	1s♂, 4j	6-8,11	Aug, Oct
Zodariidae	? sp.	3s♂, 1s♀	4,7-9	Aug, Oct

II. Order Pseudoscorpionida

Six specimens, 3♂, 3♀, of *Olpium kochi* Simon, 1881, Family Olpiidae, were collected on August from collecting sites 3 and 7, and one male specimen of the same species was collected on October from collecting site 10. Most specimens were found under stones. Only one specimen was found under bark and another walking on sand.

III. Order Scorpionida

Four scorpion species of family Buthidae were recorded during this preliminary survey; 1. *Androctonus australis*, 8 specimens from sites 1,3-6 on August and 29 specimens from sites 2,3,5,8-11 on October. 2. *Buthacus leptochelys*, 6 specimens from sites 1-3,6 on August and 1 specimen from site 8 on October. 3. *Leiurus quinquestriatus*, 1 specimen from site 1 on August and 1 specimen from site 8 on October. 4. *Orthochirus innesi*, 5 specimens from sites 7,8 on August and 3 specimens from sites 5,8,10 on October.

All specimens were almost found under stones and sometimes under cement paper bag (collecting sites 2 and 3) except a specimen of *A. australis* was found at night inside a building and two specimens of *B. leptochelys* were collected using Ultra Violet light at night (in collecting site 1 on August).

Ethological observation: When two big scorpions of *A. australis* were kept together, each one firmly grasped the metasoma of the other between the fifth metasomal segment and telson using its pedipalps and did not release it for hours. Leaving them together overnight, one killed the other by amputating the two pedipalps and the first and second pairs of legs, and devouring a small part of the prosoma including the victim's chelicerae. The same behaviour was repeated by two small scorpions of the same species when they were kept together as an experiment.

B. Burullus Protectorate

Lake Burullus was declared as protected area by the Prime Ministerial Decree No. 1444 for 1998. Its area is about 460 km². Type: Wetlands protected area.

Lake Burullus, the second largest natural lake in Egypt, has a wide diversity of various wetland habitats, ranging from fresh water swamps and reed beds in the south, to salt marshes and mudflats in the north. Sand dunes, rich in flora, dominate the sand bar separating the lake from the sea. The marine environment is represented along with sandy beach habitat, and the exchange between the brackish lake and marine waters provide a unique ecotonal zone where many marine and aquatic organisms proliferate. Burullus is by far the least disturbed and polluted of the Delta wetlands and its environs still retain some aspects of wilderness, which have been lost throughout most of the Delta. About 135 plant species have been recorded from this area. Because of its relative isolation, Burullus is also an important breeding site for several water birds and wetland species.

About 35 species of birds are known to breed at Burullus. The Mediterranean shore of the lake is of potential importance for breeding endangered marine turtles, *Carreta carreta* and *Chelonia mydas*. The Jungle Cat *Felis chaus* is known to exist in considerable numbers.

Collecting Sites:

1. West of Borg El-Burullus: 31°34'34"N 30°57'51"E
2. West of El-A'aqula: 31°31'39"N 30°49'00"E
3. Near El-Maqsaba: 31°29'47"N 30°46'06"E
4. Near Mastaroah: 31°28'30-55"N 30°41'02-15"E
5. Near El-Tolombat: 31°30'51"N 31°03'51"E
6. Near Shabab El-Kharrigeen: 31°26'14"N 30°30'31"E
7. El-Kom El-Akhdar Island: 31°26'58"N 30°49'24"E
8. Desheema Island: 31°25'00"N 30°40'09"E

I. Order Araneida

Spiders of nine families were collected from the eight sites studied during September 2000. The identification of the collected specimens with their numbers and sites of collecting are included in Table 2.

Table 2: Spiders collected from Burullus Protectorate.

Family	Species	Specimens	Sites
Agelenidae	<i>Lycosoides</i> sp.	2j	7
Araneidae	<i>Agelenatea</i> ? sp.	2♀	4
	<i>Argiope lobata</i>	1♀	6
	<i>Argiope trifasciata</i>	1♀	5,7
	<i>Cyclosa insulana</i> ?	2s♂, 1♀, 2j	4
	? sp. (2 spp.)	1♀, 1j	5,7
Eresidae	<i>Stegodyphus lineatus</i>	3♀, 1j	7
Gnaphosidae	<i>Pterotricha conspersa</i>	1♂, 5♀, 8j	1,2,4,8
	? sp	1j	4
Lycosidae	? sp.	1♀	8
Miturgidae	<i>Cheiracanthium canariense</i>	3♀	7
Philodromidae	? sp.	1 j	3
Salticidae	<i>Mogrus fulvovittatus</i>	5♀	1,3,4
	? sp. (3 spp.)	1♂, 1♀, 6j	1,2,7
Theridiidae	<i>Steatoda paykulliana</i>	1s♀	2
	? sp. (2 spp.)	2j	7

II. Order Pseudoscorpionida

Only one male specimen of *Olpium kochi*, Family Olpiidae, was collected from collecting site 2 (west of El-A'aqula village). It was found under cement paper bag, directly on sand.

III. Order Scorpionida

Seven specimens of only one species, *Androctonus amoreuxi*, of Family Buthidae were collected on September from collecting site 2 (west of El-A'aqula village). All

scorpions were almost found under cement paper bags and carton paper, sometimes hidden among paper layers.

IV. Order Solpugida

Only one juvenile specimen of *Biton* sp., Family Daesiidae, was collected from collecting site 7 (El-Kom El-Akhdar Island). It was found under a stone among plants.

C. Zaranik Protectorate

Zaranik was declared as protected area by the Prime Ministerial Decree No. 1429 for 1985. Its area is about 250 km². Type: Wetland protected area of importance for birds.

Zaranik is internationally renowned as an important bottleneck and staging area for hundreds of thousands of migrant Palaearctic water birds. More than 270 species of birds have been recorded in the area, including Pelican, Herons, Crested Lark, Quail, White Stork and Falcons. Three globally threatened bird species occur regularly: Corncrake *Crex crex*, Pallid Harrier *Circus macrourus* and Black-winged Pratincole *Glareola nordmanni*. Large numbers of Flamingo *Phoenicopterus ruber* also winter at Zaranik. Two species of threatened marine turtles are known to breed locally: Loggerhead Turtle *Carretta carretta* and Green Turtle *Chelonia mydas*. The endangered *Dermochelys coriacea* has also been recorded. Islets and littoral dunes fringing the southern margins of the Zaranik Lagoon and adjacent "sabkha" (marshy area) are thought to hold small populations of the threatened Egyptian Tortoise *Testudo kleinmanni*. The threatened Fennec Fox *Vulpes zerda* and the rare Sand Cat *Felis margarita* also occur in small numbers. Lake Bardawil and the Zaranik Lagoon are important artisan and commercial fishery.

Collecting Sites:

1. Visitors Centre: 31°04'34"N 33°27'57"E
2. North east of Visitors Centre: 31°04'39"N 33°28'08"E Alt. 24m
3. North west of Visitors Centre: 31°04'39"N 33°27'47"E Alt. 22m
4. Fishers Village: 31°08'05"N 33°28'18"E
5. Sand Bar between lake and sea: 31°08'32"N 33°28'39"E
6. Islet 1: 31°09'03"N 33°27'15"E
7. Islet 2: 31°08'25"N 33°28'03"E
8. El-Mahasna Island: 31°10'06"N 33°20'54"E
9. El-Matli Island: 31°06'34"N 33°26'22"E
10. El-Flousiyat Island 1: 31°07'04"N 33°26'11"E Alt. 15m
11. El-Flousiyat Island 2: 31°07'05"N 33°26'21"E Alt. 13m
12. El-Flousiyat Island 3: 31°07'13"N 33°26'13"E Alt. 16m
13. El-Khoweinat: 31°06'15"N 33°24'33"E Alt. 20m
14. Abu El-Husein: 31°04'26"N 33°30'39"E
15. Abu Madi (Zakar Madi, Abu Aarada): 31°02'48"N 33°23'47"E Alt. 14m
16. Observation centre: 31°07'03"N 33°29'55"E
17. East of main entrance: 31°04'11"N 33°27'43"E

I. Order Araneida

Spiders of twenty-three families were collected from the seventeen studied sites. The identification of the collected specimens with their numbers, sites and months of collecting are included in Table 3.

Table 3: Spiders collected from Zaranik Protectorate.

* = Specimens collected by another colleague on August and September 2003.

Family	Species	Specimens	Sites	Months
Agelenidae	<i>Benoitia lepida</i>	4♂, 20♀, 1s♂, 1s♀, 12j	1-3,11, 14,15	Apr-Aug, Oct, Nov
Araneidae	<i>Argiope lobata</i>	2♀	6,10	Aug, Oct
	<i>Argiope</i> sp.	2j	2	Jun, Aug
	<i>Cyclosa</i> sp.	7j	2,3	May-Jul, Oct
	? sp.	5j	5,6,14	Jul-Oct
Eresidae	<i>Stegodyphus lineatus</i>	1♂, 6♀, 2s♀, 4j	2,3,14	Apr, Jun-Aug, Oct
Filistatidae	? sp.	3j	14,15	Sep, Oct
Gnaphosidae	<i>Micaria</i> sp. *	1♀	14	Sep
	<i>Pterotricha lesserti</i>	15♂, 3♀, 11j	1-3,5,8, 10,13,17	Apr-Aug, Oct, Nov
	<i>Zelotes</i> sp.	3♂, 5♀, 2s♂, 1s♀, 8j	2,3,6,7,10, 13,14,17	May, Jul, Aug, Sep-Nov
	? sp. (6 spp.)	2♂, 6♀, 1s♀, 18j	1-3,6,10, 14,15,17	Apr-Aug, Oct
Linyphiidae	? sp.	1♀	3	Nov
Liocranidae ?	? sp. (2 spp.)	20♂, 11♀, 2s♂, 9j	1-3,5,14	May, Jul, Aug, Oct, Nov
Lycosidae	? sp. (~ 4 spp.)	11♂, 12♀, 4s♂, 1s♀, 25j	1-8,14, 15,17	Apr, May, Jul, Aug-Nov
Mimetidae	<i>Mimetes</i> sp. *	1♂	14	Aug
Miturgidae	<i>Cheiracanthium canariense</i>	1♂, 3♀, 2j	2,14,16	Jul, Aug, Nov
	<i>Cheiracanthium</i> sp.	3♀, 5j	2,6,14	Apr, May, Jul- Oct
Nemesiidae ?	? sp.	1j	3	Oct
Oonopidae ?	? sp.	1♂	1	Aug
Oxyopidae	<i>Oxyopes</i> sp.	3j	3,14	May, Aug, Sep
Philodromidae	<i>Ebo</i> sp.	1♂	3	Aug
	<i>Philodromus</i> ? sp.	3♂, 2j	2,14,17	May, Aug, Sep
	<i>Thanatus</i> sp.	2♂, 1♀, 2j	2,3,14	Jul-Sep
	? sp.	1j	14	Jul
Pholcidae	? sp.	1♂, 4♀, 4j	1,2,3,14	May, Jun, Aug, Sep, Oct
Salticidae	<i>Heliophanus decoratus</i>	2♂, 1♀, 1j	2,5,6,14	Aug-Oct
	<i>Menemerus animatus</i>	7♂, 3♀, 1s♀, 2j	1,13	Jun-Sep, Nov
	<i>Mogrus fulvovittatus</i>	1♂, 21♀, 2j	2,3,5,7, 11,14,16	Apr-Aug, Oct, Nov
	<i>Myrmarachne tristis</i> *	1♂	14	Aug
	<i>Plexippus paykulli</i>	4♀, 2s♂, 1j	1	Jun, Sep, Nov
	? sp. (~ 4 spp.)	5♀, 1s♂, 14j	1-7,9,10,17	May, Jul-Nov
Scytodidae	<i>Scytodes</i> sp.	5j	1,15	May, Oct, Nov
Sparassidae	<i>Cerbalus psammodes</i>	2♂	1	Apr, Jun
	? sp.	2j	1,15	May, Nov
Tetragnathidae	? sp. (2 spp.)	1s♂, 7j	1,9	Aug, Oct

Theridiidae	<i>Latrodectus pallidus</i> *	1♀	14	Aug
	<i>Paidiscura dromedaria</i> *	1♀	14	Aug
	<i>Steatoda ephippiata</i>	1♀	1	Jul
	<i>Steatoda paykulliana</i>	1s♂, 1s♀, 1j	8	Nov
	<i>Steatoda triangulosa</i>	1♂, 10♀, 2j	1	Apr, Jun, Sep, Nov
	<i>Steatoda</i> sp.	1j	3	May
	<i>Theridion melanostictum</i>	1♂, 1♀	1	Oct
	<i>Theridion</i> sp.	4♀	14	Jul
	? sp. (3 spp.)	4♀, 2s♂, 3j	1,3,8,12-14	May, Jul-Sep, Nov
Thomisidae	<i>Thomisus onustus</i>	1♀, 1s♀, 1j	2,3	Jul, Aug
	<i>Thomisus spinifer</i> *	1♂	14	Aug
	<i>Xysticus</i> sp.	1j	10	Aug
Uloboridae	<i>Uloborus walckenaerius</i>	2♀, 2j	2,14	Jul, Aug, Oct
Zodariidae	<i>Lachesana perversa</i>	2♂	17	May
	<i>Zodarion</i> sp.	1♂, 2♀, 4j	1,15	May, Jul, Sep, Oct

II. Order Pseudoscorpionida

Ten specimens, 4♂, 5♀, 1j, of *Olpium kochi*, Family Olpiidae, were collected on May, August, and October from collecting sites 3,4,9,11,13 and 15 from under stones and rarely in pitfall traps. Five female specimens of *Minniza* sp., Family Olpiidae, were collected on October and November from collecting sites 2, 6 and 8 from under stones or wet algae remnants (site 8). Four specimens, 1♂, 2♀, 1j, of *Rhacochelifer* ? sp., Family Cheliferidae were collected on May and November from collecting sites 2,15 and 17 from under stones.

III. Order Scorpionida

Two scorpion species of Family Buthidae were recorded during this preliminary survey. 1. *Androctonus bicolor*, 4 specimens from site 10 on August and 2 specimens from sites 1,10 on October. 2. *Buthacus leptochelys*, 2 specimens on August and 5 specimens on October from sites 1,10. All specimens were found under stones or in big pitfall traps in collecting sites. Only one specimen of *A. bicolor* was found at night inside a building on October.

IV. Order Solpugida

Only one male specimen of *Biton ehrenbergi* Karsch 1880, Family Daesiidae, was collected (light attracted) from collecting site 1 on July.

D. Ahrash Protectorate

El-Ahrash (near Rafah) was declared as protected area by the Prime Ministerial Decree No. 1429 for 1985. Its area is about 8 km². Type: Developing resources protected area.

An area of high coastal dunes, about 60m of the sea level, that has good vegetation cover. *Acacia* trees have been planted in order to stabilize the dunes and curb sand movement in the region. The vegetation of the area, despite being heavily

manipulated by man and contains several introduced elements, provides a good example of how plant life can flourish if unmolested. The vegetation of the area provides grazing and firewood to local inhabitants, but overuse is threatening to degrade and destroy this resource. Several rare, endemic and restricted animals and plants occur in the region, some of which are likely to occur in this protected area, and benefit from its conservation status.

Collecting Site:

-. Visitors Centre: 31°18'21.1"N 34°12'56.6"E Alt. 48m

I. Order Araneida

Spiders of five families were collected from the protectorate. The identification of the collected specimens with their numbers and month of collecting are included in Table 4.

Table 4: Spiders collected from Ahrash Protectorate.

Family	Species	Specimens	Months
Araneidae	? sp.	1j	Nov
Gnaphosidae	<i>Pterotricha lesserti</i>	1♀, 1s♂, 6j	Oct, Nov
	<i>Zelotes</i> sp.	1♂, 1j	Oct, Nov
Philodromidae	<i>Thanatus</i> sp.	7j	Nov
Theridiidae	? sp.	1j	Oct
Thomisidae	<i>Xysticus tristrami</i>	1♂, 1♀, 1s♀	Nov

Discussion

Arachnids were studied for the first time in the Mediterranean protected areas of Egypt. All species, with few exceptions, were recorded for the first time from these areas (El-Hennawy 2002c).

Spiders: Among the 603 collected spiders, only 27 species and 36 genera could be identified. They belong to 27 families. The identified spider species are alphabetically arranged in the following list:

Argiope lobata (Pallas, 1772)
Argiope trifasciata (Forskål, 1775)
Benoitia lepida (O.P.-Cambridge, 1876)
Cerbalus psammodes Levy, 1989
Cheiracanthium canariense Wunderlich, 1987
Cyclosa insulana (Costa, 1834)
Heliophanus decoratus L.Koch, 1875
Lachesana perversa (Savigny, 1825)
Latrodectus pallidus O.P.-Cambridge, 1872
Menemerus animatus O.P.-Cambridge, 1876
Mogrus fulvovittatus Simon, 1882
Myrmarachne tristis (Simon, 1882)
Paidiscura dromedaria (Simon, 1880)
Plexippus paykulli (Audouin, 1825)
Poecilochroa senilis (O.P.-Cambridge, 1872)
Pterotricha conspersa (O.P.-Cambridge, 1872)
Pterotricha lesserti Dalmás, 1920

Pterotricha schaefferi (Audouin, 1825)
Steatoda ephippiata (Thorell, 1875)
Steatoda paykulliana (Walckenaer, 1805)
Steatoda triangulosa (Walckenaer, 1802)
Stegodyphus lineatus (Latreille, 1817)
Theridion melanostictum O.P.-Cambridge, 1876
Thomisus onustus Walckenaer, 1805
Thomisus spinifer O.P.-Cambridge, 1872
Uloborus walckenaerius Latreille, 1806
Xysticus tristrami (O.P.-Cambridge, 1872)

The percentage of collected specimens of every spider family from the four areas is calculated (Table 5). Gnaphosidae is at the summit of number of individuals collected from the four studied protected areas. At the second position: Salticidae, Lycosidae and Agelenidae in Omayed and Zaranik; Salticidae and Araneidae in Burullus; and Philodromidae in Ahrash.

Table 5. Percentage of collected specimens of every spider family from the four areas.

Family	Omayed	Burullus	Zaranik	Ahrash
Agelenidae	11.32	3.77	9.00	
Araneidae		20.75	3.79	4.54
Clubionidae	0.94			
Dysderidae	0.94			
Eresidae		7.55	3.08	
Filistatidae	0.94		0.71	
Gnaphosidae	33.96	28.30	18.01	45.45
Linyphiidae			0.24	
Liocranidae ?			9.95	
Lycosidae	10.38	1.89	12.56	
Mimetidae			0.24	
Miturgidae		5.66	3.32	
Nemesiidae ?			0.24	
Oecobiidae	0.94			
Oonopidae ?			0.24	
Oxyopidae	8.49		0.71	
Philodromidae	0.94	1.89	2.84	31.82
Pholcidae			2.13	
Salticidae	10.38	24.53	16.35	
Scytodidae			1.18	
Sicariidae	8.49			
Sparassidae			0.95	
Tetragnathidae			1.89	
Theridiidae	0.94	5.66	8.29	4.54
Thomisidae	7.55		1.18	13.64
Uloboridae			0.95	
Zodariidae	3.77		2.13	

Mygalomorph spiders appeared once in Zaranik; only one juvenile Nemesiidae ?. The most significant species are those of the gnaphosid genus *Pterotricha*. Three species of this genus are represented in the four areas; *P. schaefferi* in Omayed, *P. conspersa* in

Burullus, and *P. lesserti* in both Zaranik and Ahrash. Also, the theridiid genus *Steatoda* is represented by three species in three areas; *S. ephippiata* in Omayed, *S. triangulosa* in Zaranik, and *S. paykulliana* in both Burullus and Zaranik. *S. ephippiata* is recorded in Egypt only from Mid Sinai (El-Hennawy 2002a, 2002b). This record from Omayed widens its range of distribution in Egypt from East to West.

Cerbalus psammodes, Family Sparassidae, is a new record from Egypt. *Latrodectus pallidus*, Family Theridiidae, is here recorded for the first time from North Sinai. It is known from Nabq protectorate, South Sinai (El-Hennawy 2002a, 2003). The first Egyptian male *Mimetus* specimen, Family Mimetidae, was collected from Zaranik. *Cheiracanthium canariense*, Family Miturgidae, was discovered for the first time from Egypt during this study (El-Hennawy 2002a). This species was only known from Canary Islands.

Zaranik has the highest diversity of spider species. This is related to the diversity of insects. El-Moursy et al. (2001) recorded 187 species and subspecies, belonging to 49 families of 15 orders, of insects from Zaranik protectorate. There are many other unidentified species of insects there.

Pseudoscorpions: Three species of pseudoscorpions were recorded during this study from three areas. *Olpium kochi* Simon 1881, Family Olpiidae, is the mostly encountered species in Omayed, Burullus and Zaranik. *O. kochi* is known in Egypt from Wadi Natron, Cairo, Assuan and Wadi El-Raiyan (El-Hennawy 1988, 1991). The second olpiid species, *Minniza* sp., and *Rhacochelifer* ? sp. of Family Cheliferidae were only found in Zaranik.

Scorpions: Six scorpion species were encountered during the survey. All of them belong to Family Buthidae (Table 6).

Table 6: Scorpions recorded from three protectorates with the number of specimens.

Species	Omayed	Burullus	Zaranik
<i>Androctonus amoreuxi</i> (Audouin 1825)		7	
<i>Androctonus australis</i> (Linnaeus 1758)	37		
<i>Androctonus bicolor</i> Ehrenberg 1828			6
<i>Buthacus leptochelys</i> (Ehrenberg 1829)	7		7
<i>Leiurus quinquestriatus</i> (Ehrenberg 1828)	2		
<i>Orthochirus innesi</i> Simon 1910	8		

Genus *Androctonus* Ehrenberg 1828 is represented in this study by three species, each of them in only one protected area. *A. amoreuxi* is only found in Burullus. This species is widely distributed in Egypt and is already recorded from many regions including Baltim near Burullus Lake (El-Hennawy 1992). *A. australis* is only found in Omayed. It is known from Mersa Matrouh and Sallum, west of this area. *A. bicolor* is only found in Zaranik. It is known before from Mersa Matrouh to Alexandria and Sinai. *Buthacus leptochelys* is found in both Omayed and Zaranik. It is known from the Mediterranean coastal strip including Alexandria to Port Said and Sinai. Both *Leiurus quinquestriatus* and *Orthochirus innesi* are only found in Omayed. *L. quinquestriatus* is recorded from Mersa Matrouh and *Orthochirus* species are known from the region of Sallum. Omayed has the highest diversity of scorpions among the four studied areas. The ethological observation recorded between two *A. australis* scorpions means that there is no specific tolerance in this species while the seven specimens of *A. amoreuxi* from Burullus were kept together without cannibalism for about a week.

Sun-Spiders: Sun-spiders were only recorded from Burullus and Zaranik. The same genus, *Biton* Karsch 1880, was recorded. This genus is widely distributed in Egypt and *Biton ehrenbergi* Karsch 1880 is known in Egypt from Cairo, El-Fayum, Luxor, and Elephantine (Assuan) (El-Hennawy 1998). It is its first record from northern Sinai. This study leads us to state that it is necessary to make continuous seasonal survey of all arachnid species in the coastal protected areas of Egypt to elucidate their importance in their environment. A thing that enables the monitoring of these species in relation to the environmental changes which affect them in these areas.

Acknowledgments

The author is greatly indebted to the managers of the four protected areas, Mohammad El-Esawy (Omayed), Fayed El-Shamly (Burullus), Saad El-Din Osman (Zaranik), and Samir Nassar (Ahrash), and all workers in these areas. Their assistance was very necessary to this work. Special thanks are to the staff of Zaranik whose hospitality is unforgettable.

Dr. Gihan Sallam (Cairo) provided me with specimens from site 14 of Zaranik protectorate collected during August and September 2003. Dr. Abdel-Nasser H. Ali and Dr. Tarek Tantawi (Alexandria) kindly admitted for examination of spiders in their collection from Omayed.

Sincere thanks are due to my friends and colleagues: Drs. Hassan H. Fadl, Mahmoud S. Abd El-Dayem, Magdi S. El-Hawagry, and Mostafa R. Sharaf who constitute with me the Egyptian field trips team of Entomology and Arachnology. Their cooperation and assistance helped me much during my trips to protected areas of Sinai.

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***Anagraphis pallens* Simon, 1893, a new record from Turkey (Araneae : Prodidomidae)**

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Abstract

Anagraphis pallens Simon, 1893 is the first record of Family Prodidomidae in Turkey.

Keywords: Arachnida, Spiders, Prodidomidae, *Anagraphis pallens*, Turkey.

Introduction

Prodidomidae had been formerly dealt with as a part of the Gnaphosidae due to gross morphological similarities (i.e., enlarged, well-separated spinnerets), but it was revalidated to family rank by Platnick (1990) based on more refined spinneret spigot morphology. The eye pattern almost creates a circle due to the extremely procurved nature of the posterior eye row intersecting with the straight anterior eyes. The anterior median eyes of most prodidomids are darkly pigmented whereas the other six eyes are not. Other characteristics that help in distinguishing these spiders are protruding, geniculate chelicerae and unarmed tarsal claws (Vetter, 1996).

In Prodidomidae, 160 species belonging to 26 genera have been described (Platnick, 2005). In fact, no prodidomid species have been hitherto recorded in Turkey (Bayram, 2002). In the present paper, *Anagraphis pallens* Simon, 1893 is reported as a new record for the Turkish araneofauna.

Material and Methods

The present study is based on material deposited in the collections of the Arachnology Museum of Niğde University (NUAM). Four males and two females were examined in this study. The specimens were preserved in 70% ethanol. The identification and drawings were made by means of a SZX9 Olympus stereomicroscope with a camera lucida. The sketches of Levy (1999) helped in identification. All measurements are in millimetres.

Results

Material examined: 4 ♂♂ and 1 ♀ were recorded from Niğde province in the Central Anatolia of Turkey (34°36'E, 37°55'N). They were collected under stones on 19.VI.2001. An additional female was collected from Kayseri province (35°10'E, 38°36'N) on 24.VI.2001 by pitfall trapping.

Figs. 1-2: *Anagraphis pallens* Simon, 1893

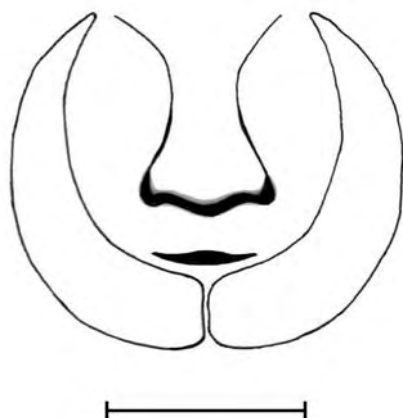
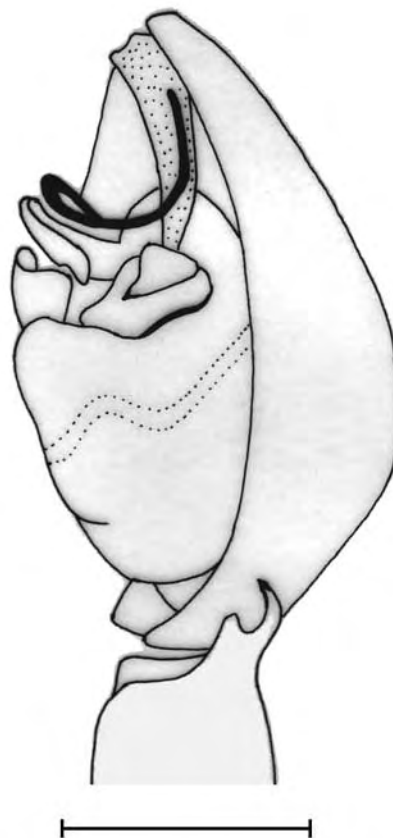


Fig. 1. Female epigynum, ventral view.

Fig. 2. Male palp, retrolateral view.
(Scale line = 0.2 mm)



Description: Medium-sized, light-coloured spiders. Carapace with a distinct fovea. Anterior lateral eyes slightly larger than all other eyes or equal to posterior lateral eyes. Anterior spinnerets larger than posterior spinnerets. Epigynum and male palp (Figs. 1-2) resemble the description of Levy (1999) and Chatzaki *et al.* (2002).

Male (NUAM 51/0002-5): Body length 4.90-7.00; carapace length 2.10-3.00, width 1.60-2.10; length of legs: I 7.64-10.73, II 6.41-9.01, III 6.11-8.58, IV 8.25-11.58; leg I segments length: coxa 0.71-1.00, trochanter 0.33-0.47, femur 1.72-2.42, patella 0.89-1.25, tibia 1.69-2.37, metatarsus 1.30-1.82, tarsus 1.00-1.40.

Female (NUAM 38/0003 & NUAM 51/0006): Body length 6.90-9.80; carapace length 2.90-3.60, width 2.20-3.00; length of legs: I 10.06-11.44, II 8.45-9.60, III 8.04-9.15, IV 10.86-12.35; leg I segments length: coxa 0.93-1.06, trochanter 0.43-0.49, femur 2.27-2.58, patella 1.17-1.33, tibia 2.23-2.53, metatarsus 1.71-1.95, tarsus 1.32-1.50.

Distribution: South Africa, Libya, Malta, Syria, Israel and Crete (Levy, 1999; Chatzaki *et al.*, 2002).

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A new species of genus *Eresus* from Algeria and Tunisia (Araneida : Eresidae)

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Abstract

A new species of the spider genus *Eresus*, family Eresidae, is described from Algeria and Tunisia and named *Eresus jerbae*.

Keywords: Spiders, Eresidae, *Eresus jerbae*, Tunisia, Algeria, North Africa, Taxonomy, new species.

Introduction

Among the 16 species and 7 subspecies of genus *Eresus* Walckenaer, 1805 (Roewer, 1954; Platnick, 2005), four species were recorded from Algeria: *E. albopictus* Simon, 1873b, *E. algericus* El-Hennawy, 2004a, *E. cinnaberinus latefasciatus* Simon, 1910, and *E. solitarius* Simon, 1873a; and only *E. cinnaberinus* (Olivier, 1789) was recorded from Tunisia (Simon, 1910).

During my work on reviewing the spiders of genus *Eresus* in Egypt (El-Hennawy, 2004b), I examined specimens from Muséum National d'Histoire Naturelle, Paris (MNHN) to find that there are misidentified specimens as *E. petagnae* from Tunisia and *E. semicanus* from Algeria. These specimens are not matching with any of the known descriptions of *Eresus* species. They belong to another species, which is described below as a new species. The description only depends on the material deposited in MNHN.

All measurements were taken in millimetres.

Abbreviations used: ALE = anterior lateral eye; AME = anterior median eye; Id = eyes inter-distances; L = length; PLE = posterior lateral eye; PME = posterior median eye; TL = total length; W = width.

***Eresus jerbae* new species**
(Figs. 1-4. Tables 1-2.)

Type Material: Holotype: Female. Tunisia: Djerba (Ltr.), (MNHN) bottle no. 471 (tube no. AR 835), misidentified as *Eresus petagnae*.

Other Material: 1♀, 2j Tunisia, Djerba (Ltr.), (MNHN) bottle no. 471 (tube no. AR 835) misidentified as *Eresus petagnae*; 1♀ Algeria, Birin (G. Seurat 1913), (MNHN) bottle no. 471 (tube no. AR 842) misidentified as *Eresus semicanus*.

Diagnosis: Female of this species is similar to the female of *Eresus semicanus* Simon, 1908. Its genitalia is differentiated by the presence of two small depressions adjacent to the anterior extremities of the vulvae (Figs. 1-2; white arrows) instead of the single wide depression of *E. semicanus* (El-Hennawy, 2004b).

Etymology: The species name is a noun in apposition taken from the type locality.

Description: Female (Holotype): TL 13.06; Cephalothorax L 3.67; Cephalic part: L 2.72, W 2.97; Thoracic part: W 2.80. Crimson red, covered by creamy white hairs mixed with light brown hairs in the cephalic area, hairs generally less in density in the thoracic area. Cephalic area gradually inclined into thoracic area. Cephalothorax L : W anteriorly = 1.24; L : W posteriorly = 1.31.

Eyes: posterior medians (PME) largest; 2½ times larger than anterior medians (AME); posterior laterals (PLE) less than 1½ the diameter of the AME; ALE and PLE equal. Eye measurements (diameters and interdistances): AME 0.10, ALE 0.14, PME 0.25, PLE 0.14, AM-AM 0.14, AL-AL 2.28, PM-PM 0.31, PL-PL 2.01, AM-AL 0.97, AM-PM 0.07. (Id PME : Id AME = 2.21; Id PLE : Id ALE = 0.88).

Sternum (L 2.12) and coxae: lighter than cephalothorax. Labium (L 0.95), maxillae (L 1.32) and chelicerae: like cephalothorax; covered by light brown hairs mixed with white hairs. Chelicera with strong boss and a black tooth against the fang; its internal edge is black.

Legs and pedipalps: orange-brown covered by creamy white hairs. Tarsi, metatarsi and tibiae of legs I, II partly darker. Tarsi and tibiae of pedipalps darker. Pedipalp with a claw.

Table 1: Legs measurements (mm)

Leg	I	II	III	IV
Femur	2.12	1.85	1.59	2.54
Patella	1.22	1.17	1.17	1.38
Tibia	1.22	1.01	0.90	1.59
Metatarsus	1.01	0.95	0.85	1.27
Tarsus	0.85	0.79	0.48	0.58
Total length	6.42	5.77	4.99	7.36

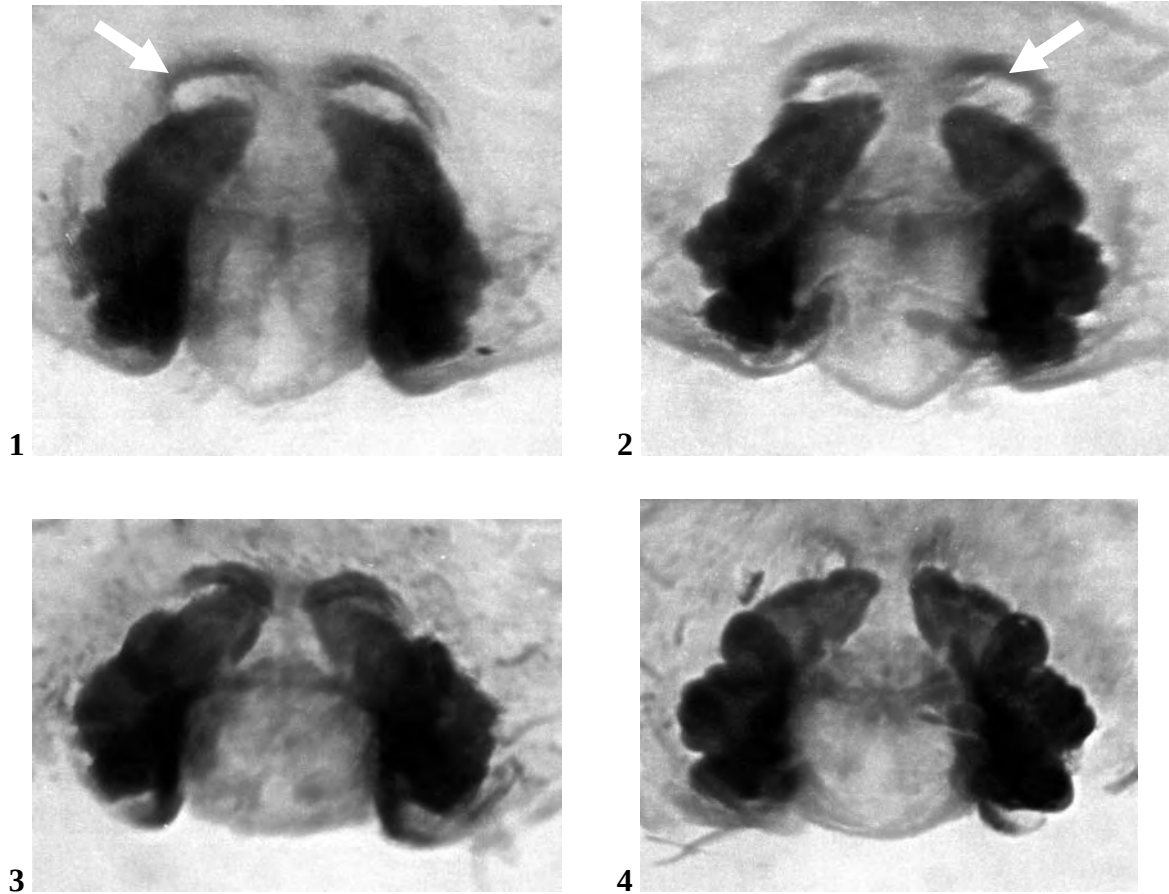
Relative length of legs 87 : 78 : 68 : 100. Leg formula IV-I-II-III.

L leg I : L cephalothorax = 1.75.

Spination pattern: spines only on ventral side of tarsi and metatarsi, and distally on tibiae; few on legs I & II, numerous on legs III & IV.

Abdomen: L 10.61; yellowish white, covered by light brown hairs. Cribellum: bipartite.

Genitalia: Epigynum of this species is similar to that of the female of *E. semicanus* Simon, 1908. It has two small depressions adjacent to the anterior extremities of the vulvae (Figs. 1-2; white arrows) instead of the wide single depression between the chitinous ridge and chitinous plate of *E. semicanus* (El-Hennawy, 2004b).



Figs. 1-4: *Eresus jerbae* n.sp. 1-2. Holotype ♀ (Jerba Island, Tunisia). 3-4. Paratype ♀ (Birine, Algeria). 1, 3. Epigynum, ventral view. 2, 4. Vulvae, dorsal view.

Measurements of Other Material:

A. 1♀ Tunisia, Djerba (Ltr.), (MNHN) bottle no. 471 (tube no. AR 835) misidentified as *Eresus petagnae*.

TL 13.06; Cephalothorax L 4.49; Cephalic part: L 3.65, W 4.16; Abdomen L 9.38

B. 1♀ Algeria, Birin (G. Seurat 1913), (MNHN) bottle no. 471 (tube no. AR 842) misidentified as *Eresus semicanus*.

TL 13.87; Cephalothorax L 5.44; Cephalic part: L 3.91, W 4.25; Thoracic part: W 3.65. Cephalothorax L : W anteriorly = 1.28; L : W posteriorly = 1.49.

Sternum L 2.97; Labium L 0.90; Maxillae L 1.64. Abdomen L 9.79

Eye measurements (diameters and interdistances): AME 0.14, ALE 0.17, PME 0.30, PLE 0.17, AM-AM 0.17, AL-AL 3.18, PM-PM 0.48, PL-PL 2.86, AM-AL 1.24, AM-PM 0.09. (Id PME : Id AME = 2.82; Id PLE : Id ALE = 0.90).

Table 2: Legs measurements (mm)

Leg	I	II	III	IV
Femur	2.91	2.38	2.12	3.18
Patella	1.38	1.43	1.22	1.85
Tibia	1.59	1.38	1.32	2.01
Metatarsus	1.59	1.32	1.17	1.75
Tarsus	1.01	0.95	0.58	0.85
Total length	8.48	7.46	6.41	9.64

Relative length of legs 88 : 77 : 66 : 100. Leg formula IV-I-II-III.
L leg I : L cephalothorax = 1.56.

Male: Unknown.

Distribution: **Algeria:** Birine, about 125 km south of Alger (Algiers). **Tunisia:** Jerba island (about 33°47'31"N 10°53'51"E).

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Survey and populations of spiders and other arthropods in cucurbit and legume fields in Al-Kanater (Egypt)*

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Abstract

Survey on spiders and other arthropods inhabiting fields of four legume and five cucurbit crops, as well as seasonal abundance of spiders were investigated at Al-Kanater Agricultural Research Station during one year to find 16 spider families, of about 33 genera and 33 species. Spring showed the greatest number of spider taxa (29) followed by 22 in summer, while autumn recorded the lowest number (15). Other associated arthropods included three classes, 10 orders and about 40 genera, i.e. one order of Crustacea, three of Chilopoda (Myriapoda), and six of Insecta which included about 40 species in more than 33 genera and 22 families.

Keywords: Survey, Seasonal abundance, Spiders, Insecta, Chilopoda, Crustacea, Egypt.

Introduction

Spiders as predators play an important role in agroecosystems. They are considered a biocontrol agent against economic pests of various agricultural crops. Therefore, survey on spiders and other arthropods inhabiting fields of four legumes (peas, kidney bean, cowpea and broad bean) and five cucurbits (squash, cucumber, sweet squash, muskmelon, watermelon and watermelon intercropped with maize) crops as well as its seasonal abundance were investigated at Al-Kanater Agricultural Research Station during one year (October 2000 - August 2001). Kidney bean, squash and cucumber were subjected to survey twice a year in an agricultural rotation as summer and winter crops, while other crops were surveyed once. Watermelon was surveyed as monoculture and when intercropped with maize.

* This article is a part of M.Sc. Thesis of the last author (NA).

Material and Methods

This study was carried out at Al-Kanater Agricultural Research Station, including nine vegetable crops of two botanical families. Four belong to Leguminosae and these are peas, *Pisum sativum* (from 11 November to 27 March), kidney bean, *Phaseolus vulgaris* (from 11 October to 14 February and from 20 March to 10 July), cowpea, *Vigna sinensis* (from 16 May to 21 August) and broad bean, *Vicia faba* (from 10 January to 29 May). The other five crops belong to Cucurbitaceae. They are squash, *Cucurbita pepo* (from 3 October to 13 December and from 10 April to 10 July), cucumber, *Cucumis sativus* (from 3 October to 29 November and from 10 April to 10 July), sweet squash, *Cucurbita maschata* (from 17 April to 10 July), musk melon, *Cucumis melo* var. *reticulata* (from 29 May to 17 July) and watermelon, *Citrullus vulgaris* (from 17 April to 10 July). Watermelon was also intercropped with maize (from 8 May - 17 July).

Pitfall traps of plastic cups, each 8 cm in diameter and 11 cm deep were used to survey spiders and associated soil arthropods inhabiting investigated fields (Southwood, 1987). Six traps were used for every investigated vegetable crop, lasted for 48 hour/week and regularly applied for each crop depending on its duration. Captured arthropods were carefully stored for identification (Identification of spiders is the responsibility of the second author (HE)). Population of the spider families were assessed as percentage of the entire captured spiders in each crop. The family percentage less than 5% was categorized as rare (r); that of 5-33% = low occurrence (l); that of 33-66% = medium occurrence (m); and that of more than 66% was described as high occurrence (h).

A list of identified spider species, alphabetically arranged, is presented at the end of 'Results' section with authors and dates to avoid mentioning them inside the tables.

Results

Occurrence of spiders in the studied crops

The family Lycosidae proved to be the dominant among spider families where it had high occurrence (h) in fields of 11 of the 13 investigated vegetable crops (Table 1). This coincides with Hussein (1999) who reported that Lycosidae comprised 86.42% of the whole spider population in 8 vegetable crop fields. This may be due to the ecological abiotic and biotic factors in such vegetable crops that fit the requirements of members of this family, e.g. temperature, relative humidity, shelter, leaf texture and abundance and diversity of the pest prey species. However, the family Lycosidae recorded low occurrence in winter squash only (5.3%). This may be due to the cold temperature during winter season when large leaf area of squash plants completely shades the soil from sun.

The family Linyphiidae showed the second rank in occurrence. It recorded medium occurrence (m) in one crop (broad bean) and low occurrence (l) of the whole spider populations in 9 crops, i.e. winter and summer kidney bean, peas, winter and summer cucumber, winter and summer squash, muskmelon and sweet squash. It constituted 33.33% of the whole spider population in the broad bean field.

The family Theridiidae occurred in low percentages in only three fields of studied crops averaging 5.78, 6.52 and 5.69% in winter kidney bean, winter squash and summer squash respectively while it was rare in the other ten crops (Table 1).

It is worth noting that families Lycosidae, Linyphiidae, Philodromidae and Theridiidae occurred in all the 13 studied crop fields where Lycosidae were found in high percentage followed by Linyphiidae. This may be due to the fitness of the habitat of the vegetable crops for these spider families.

Table 1: Relative abundance of spider families in different studied vegetable crops during the study period.

Crops	Legume Crops					Cucurbit Crops							
	Winter Kidney Bean	Peas	Broad Bean	Summer Kidney Bean	Cow Pea	Winter Cucumber	Winter Squash	Summer Cucumber	Summer Squash	Sweet Squash	Watermelon	Watermelon Intercropped	Muskmelon
Families													
Agelenidae	r	-	r	-	-	-	-	-	-	-	-	-	-
Araneidae	-	-	r	-	-	-	-	r	r	-	-	-	r
Dictynidae	-	-	r	-	-	-	-	-	-	-	-	-	r
Dysderidae	r	-	-	-	-	-	-	-	-	-	r	-	-
Gnaphosidae	r	r	r	r	r	r	-	r	r	r	r	r	r
Linyphiidae	l	l	m	l	r	l	l	l	l	l	r	r	l
Lycosidae	h	h	m	h	h	h	l	h	h	h	h	h	h
Miturgidae	r	-	-	r	r	-	-	-	-	-	-	-	-
Philodromidae	r	r	r	r	r	l	l	r	r	r	r	l	r
Pisauridae	r	-	r	-	-	-	-	-	-	-	-	-	-
Salticidae	-	r	r	r	r	r	-	r	-	r	r	r	r
Scytodidae	-	-	-	-	-	-	-	-	r	r	-	-	-
Sicariidae	-	-	r	r	-	-	-	-	-	-	-	-	-
Tetragnathidae	r	r	r	-	-	-	-	-	-	-	-	-	-
Theridiidae	l	r	r	r	r	r	l	r	l	r	r	r	r
Titanoecidae	-	-	-	-	-	-	-	r	r	-	-	-	-

r = rare (< 5%), l = low (5–33%), m = medium (33-66 %), h = high occurrence (> 66%).

The family Philodromidae was also found in low percentage, i.e. 5.67, 5.0 and 5.48 in 3 crops (winter cucumber, winter squash and watermelon intercropped with maize), while being rare in the other crops (Table 1). The other recorded families appeared in rare numbers associated with some crops and disappeared from others. Of these, the family Gnaphosidae which only disappeared from winter squash while Salticidae disappeared from winter kidney bean and winter and summer squash. It seems that there is a possible relation between squash and salticid spider disappearance.

The families Agelenidae, Dictynidae, Dysderidae, Pisauridae, Scytodidae, Sicariidae and Titanoecidae were found in only two crops from total 13 crops. Along the study period, two of these rare families Agelenidae and Pisauridae occurred only in winter kidney bean and broad bean while Scytodidae and Titanoecidae only appeared in summer season, titanoecids inhabited summer cucumber and summer squash and the scytodids occurred in summer squash and sweet squash (Table1).

Table 2: Occurrence of spider families, genera and species in legumes in Al-Kanater Agricultural Research Station.

Taxa	Winter Kidney Bean				Peas				Broad Bean				Summer Kidney Bean				Cowpea			
	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN
Agelenidae																				
<i>Lycosoides</i> sp.	1			1																
<i>Tegenaria</i> sp.								1	1											
Araneidae *								1	1											
Dictynidae *								1	2			3								
Dysderidae <i>Dysdera</i> sp.		1		1																
Gnaphosidae *					2	1	1	4	1			1							1	1
<i>Micaria</i> sp.	2			2	2		1	3							2	2	6			6
<i>Setaphis subtilis</i>	1			1	1			1					1			1				
<i>Zelotes</i> sp.									1	1		2	3			3	6	1	1	8
Linyphiidae *	7	2	1	10	15	13	2	30	16	8	5	29	5	9	2	16	2	4	3	9
<i>Erigone dentipalpis</i>					6	1		7	19	5		24	24	1		25	5			5
<i>Gnathonarium dentatum</i>	3			3					2	1		3	1			1				
<i>Prinerigone vagans</i>	2			2	8	1		9	4	1		5	10	1		11	1			1
Lycosidae *			34	34	1		34	35			22	22			30	30			85	85
<i>Hogna ferox</i>	1		1	2	3		1	4		1		1	4	1		5	9	1		10
<i>Pardosa injucunda</i>	1			1			1	1						2	2	2	2			2
<i>Wadicosa fidelis</i>	56	16		72	34	8	3	45	18	9		27	27	8	35	35	137	47		184
G1	11	1		12	50	17		67	30	7		37	117	21		138	69	25		94
G2									8			8	4	1		4	3			3
Miturgidae																				
<i>Cheiracanthium</i> sp.		1		1									1			1	1			1
Philodromidae																				
<i>Thanatus albini</i>	4			4	4			4	5	1		6	6	3	2	9	10	2	1	13
Pisauridae *									1			1								
Salticidae *					2	1		3	2			2	4	2	1	7	10	1		11
<i>Menemerus</i> sp.													1			1				
Sicariidae <i>Loxosceles</i> sp.									1	1		2	1			1				
Tetragnathidae *	1			1	2			2	6			6								
Theridiidae *		1	1	2													1			1
<i>Steatoda erigoniformis</i>	8			8	3	1		4	3			3	7			7	11	1		12
Total	112	24	37	173	133	43	43	219	119	37	27	183	218	48	35	301	263	83	91	447
Average	7.46	3.42	9.25	8.65	9.5	5.38	6.1	12.88	6.6	3.08	13.5	8.71	12.8	5.33	8.75	15.05	18.2	9.2	18.2	24.8
S.D.	13.5	5.15	14.28	16.4	14.06	6.08	11.4	18.8	7.89	2.75	8.5	10.53	27.8	6.2	12.27	29.9	35.6	15.25	33.4	46.8

Using total of 50, 162, 114, 96 & 84 pitfall traps in winter kidney bean, peas, broad bean, summer kidney bean and cowpea respectively.

J = Juveniles could not be identified to more than family level. * = Only identified to family level. TN = total number.

Table 3: Occurrence of spider families, genera and species in cucumber and squash in Al-Kanater Agricultural Research Station.

Taxa	Winter Cucumber				Winter Squash				Summer Cucumber				Summer Squash			
	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN
Araneidae *										1		1		1		1
Gnaphosidae *	1			1												
Micaria sp.										1		1				
Setaphis subtilis		1		1										1		1
Synaphosus sp.										1		1				
Zelotes sp.									1	2		3		1	1	2
Linyphiidae *		4		4	1	3		4	6	10	8	24	5	11	2	18
Erigone dentipalpis	1	1		2	1	13		14	8	14		22	6	6		12
Gnathonarium dentatum													1			1
Prinerigone vagans						1		1	1	3		4		8		8
Lycosidae *		1	37	38			7	7		1	67	68		2	51	53
Hogna ferox										1	1	2		6		6
Pardosa injucunda					1	3		4	2	9		11		12	38	50
Wadicosa fidelis	10	23	5	33	4	6		10	3	8		11		1	4	5
G1	15	36		51		2		2	45	133		178		19	61	80
G2									2	6		8		6	30	36
Miturgidae																
Cheiracanthium sp.					1			1								
Philodromidae																
Thanatus albini	1	5	2	8					1	9	8	18	2	4	1	7
Salticidae *		1		1						3	2	5				
Scytodidae Scytodes sp.														1		1
Theridiidae *						1		1	1		1	2		1	1	2
Steatoda erigoniformis		1		1		2		2		8	1	9		15		15
Titanoecidae *										1		1		1		1
Total	28	74	39	141	8	31	7	46	73	210	87	369	51	190	58	299
Average	5.6	7.4	19.5	12.8	1.6	3.8	7	4.6	6.08	11.6	10.8	16.7	6.37	10.5	9.6	14.2
S.D.	5.8	11.5	17.5	17.6	1.2	3.7	0	4.2	11.9	29.6	21.36	37.9	5.91	15.8	18.4	21.2

Using total of 42, 42, 78 & 78 pitfall traps in winter cucumber, winter squash, summer cucumber and summer squash respectively.
J = Juveniles could not be identified to more than family level. * = Only identified to family level. TN = total number.

Table 4: Occurrence of spider families, genera and species in the other cucurbits in Al-Kanater Agricultural Research Station.

Taxa	Sweet Squash				Watermelon				Watermelon intercropped with maize				Muskmelon			
	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN	♂	♀	J	TN
Araneidae *					1	1	2	4								
Dictynidae *						1		1								
Dysderidae <i>Dysdera</i> sp.													1			1
Gnaphosidae *	1			1												
<i>Micaria</i> sp.					1			1	2			2				
<i>Zelotes</i> sp.	1	1		2	2		1	3	3			3		1		1
Linyphiidae *	9	2	4	13	8	12	4	24						1		1
<i>Erigone dentipalpis</i>	15			15	7	2		9	5	1		6	1			1
<i>Gnathonarium dentatum</i>		1		1					1	1		2				
<i>Prinerigone vagans</i>	5			5	4			4	2			2				
Lycosidae *		2	85	87	1	2	82	85			61	61	29	2	29	31
<i>Hogna ferox</i>	7	2	2	11	7	5		12	3			3	4			4
<i>Pardosa injucunda</i>	7	4	3	14	4	3		7								
<i>Wadicosa fidelis</i>	5	3		8	28	14		42	67	21		88	37	16		53
G1	207	116		323	138	133		271	70	31		101	31	11		42
G2	9	4	1	14	3	2		5	1			1	3	1		4
Philodromidae																
<i>Thanatus albini</i>	6	1	2	9	7	4	7	18	10	1	5	16	5			5
Salticidae *	7	2	2	11	7	5		12	4			4	1	1	2	4
<i>Plexippus paykulli</i>										1		1				
Scytodidae <i>Scytodes</i> sp.	1			1												
Theridiidae *						1	1	2							1	1
<i>Kochiura aulica</i>					1			1								
<i>Statoda erigoniformis</i>	15		1	16	11			11	2			2		1		1
Total	293	138	100	531	230	185	97	512	170	56	66	292	83	30	32	149
Average	18.3	12.5	12.5	27.9	16.16	11.56	16.16	0.32	13.07	9.3	33	18.25	10.37	6	10.6	11.46
S.D.	48.9	32.7	27.4	71.95	29.5	31.53	29.5	0.8	23.7	12.1	28	32.17	14.21	6.18	15.88	18.03

Using total of 71, 71, 59 & 42 pitfall traps in sweet squash, watermelon, watermelon intercropped with maize and muskmelon respectively. J = Juveniles could not be identified to more than family level. * = Only identified to family level. TN = total number.

Occurrence of spider taxa in legume crops

Results proved the occurrence of about 30 spider species and genera collected from legume fields, i.e. about 17, 15, 20, 19 and 17 species and genera from winter kidney bean, peas, broad bean, summer kidney bean and cowpea respectively (Table 2).

The highest occurrence was recorded for the unidentified lycosid genus one G₁ (67, 94 and 138 individuals in peas, cowpea and summer kidney bean respectively) followed by *Wadicosa fidelis*: 45, 72 and 184 individuals for peas, winter kidney bean and cowpea respectively.

The rarest taxa of spiders were *Lycosoides* sp. and *Dysdera* sp. in winter kidney bean, Araneidae and *Tegenaria* sp. in broad bean, *Cheiracanthium* sp. in winter and summer kidney bean, Pisauridae in broad bean, *Menemerus* sp. in summer kidney bean and *Loxosceles* sp. in broad bean and summer kidney bean. No females of *Steatoda erigoniformis* were obtained by the traps during the study period in broad bean, winter and summer kidney bean while one female was recorded in peas and another in cowpea.

Occurrence of spider taxa in cucumber and squash

Spiders of about 25 species and genera were collected from cucumber and squash in winter and summer. Identification of these spiders with their age structure and population are included in Table (3).

During the winter season, about 14 species and genera were collected. Six of them were recorded in both crops while four taxa were only collected from cucumber, of which only one individual of *Setaphis subtilis* and 8 individuals of *Thanatus albinus* were recorded. Four taxa were only collected from squash, three of them, i.e. *Prinerigone vagans*, *Cheiracanthium* sp. and an unidentified theridiid, recorded the same lowest occurrence of one individual while the fourth, *P. injucunda*, was recorded by 4 adult individuals. The highest occurred taxa in cucumber and squash were the lycosid G₁ and *Erigone dentipalpis* which recorded 51 and 14 individuals respectively.

During the summer season, about 21 species and genera were recorded. Fifteen of them were collected from both cucumber and squash. Three taxa were only collected from cucumber, i.e. *Micaria* sp., *Synaphosus* sp. and unidentified salticids that were represented by 1, 1 and 5 individuals respectively. Other three taxa were only recorded from squash, each by one individual, i.e. *S. subtilis*, *G. dentatum* and *Scytodes* sp. The highest populations were recorded for the lycosid G₁ by 178 and 80 individuals in cucumber and squash respectively.

Total number of spiders' populations in winter and summer cucumber (141 and 369) were higher than in squash (46 and 229 individuals) respectively.

Occurrence of spiders in the other cucurbit crops

About 24 spider species and genera were recorded in the other cucurbits, of which about 16, 18, 14 and 13 species and genera collected from sweet squash, watermelon, watermelon intercropped with maize and muskmelon respectively (Table 4).

G₁ of the family Lycosidae recorded the highest occurrence in sweet squash, watermelon and watermelon intercropped with maize 323, 271 and 101 individuals respectively. The highest occurrence in muskmelon was recorded by 53 individuals of *W. fidelis*. The lowest populations were for an unidentified gnaphosid, *G. dentatum* and *Scytodes* sp. in sweet squash, an unidentified dictynid, *Micaria* sp. and *Kochiura aulica* in watermelon, an unidentified lycosid G₂ and *Plexippus paykulli* in watermelon intercropped with maize and *Dysdera* sp., *Zelotes* sp., an unidentified linyphiid, *E. dentipalpis*, an unidentified theridiid and *S. erigoniformis* in muskmelon. These recorded the same number of one individual per each.

Table 5: Seasonal abundance of spiders in the studied crops.

Taxa	Autumn	Winter	Spring	Summer
	T	T	T	T
Agelenidae <i>Lycosoides</i> sp.	-	0.08	-	-
<i>Tegenaria</i> sp.	-	0.08	-	-
Araneidae *	-	-	0.02	0.10
Dictynidae *	-	-	0.04	0.02
Dysderidae <i>Dysdera</i> sp.	-	0.05	-	0.05
Gnaphosidae *	0.08	0.05	0.14	-
<i>Micaria</i> sp.	0.04	0.10	0.08	0.65
<i>Setaphis subtilis</i>	0.09	0.05	0.07	-
<i>Synaphosus</i> sp.	-	-	0.20	-
<i>Zelotes</i> sp.	-	-	0.02	0.92
Linyphiidae *	0.63	1.68	4.11	0.44
<i>Erigone dentipalpis</i>	0.86	0.79	2.72	0.08
<i>Gnathonarium dentatum</i>	-	0.10	0.10	0.04
<i>Prinerigone vagans</i>	0.33	0.62	1.57	0.18
Lycosidae *	4.00	1.45	5.72	9.77
<i>Hogna ferox</i>	0.04	0.05	0.38	0.79
<i>Pardosa injucunda</i>	0.24	0.05	0.69	1.47
<i>Wadicosa fidelis</i>	5.81	4.37	3.92	19.26
G1	4.10	3.79	18.74	14.17
G2	-	-	1.21	1.17
Miturgidae <i>Cheiracanthium</i> sp.	-	0.10	0.21	-
Philodromidae <i>Thanatus albini</i>	0.73	0.28	1.80	2.24
Pisauridae *	-	0.08	0.05	-
Salticidae *	-	-	0.38	1.34
<i>Menemerus</i> sp.	-	-	-	0.02
<i>Plexippus paykulli</i>	-	-	-	0.02
Scytodidae <i>Scytodes</i> sp.	-	-	-	0.04
Sicariidae <i>Loxosceles</i> sp.	-	-	0.21	-
Tetragnathidae *	-	1.09	-	-
Theridiidae *	0.04	0.10	0.08	0.06
<i>Kochiura aulica</i>	-	-	-	0.02
<i>Steatoda erigoniformis</i>	0.45	0.29	0.77	1.81
Titanoecidae	-	-	0.02	-
Total	17.44	15.25	43.25	54.69
Average	1.14	0.69	1.47	2.19
S.D.	1.80	1.15	3.50	4.73

* = Individuals only identified to family level. T = Total number / trap.

Seasonal abundance of spiders in the studied crops

About 33 species of 33 genera and 16 families were recorded throughout the four seasons of the year. *Hogna ferox*, G1, *W. fidelis* and *P. injucunda* (Family Lycosidae), *E. dentipalpis*, *P. vagans* and *G. dentatum* (Family Linyphiidae), *S. erigoniformis* (Family Theridiidae) and *T. albini* (Family Philodromidae) were the most abundant during this study (Table 5). *S. erigoniformis* was recorded for the first time from Qalyubiya governorate. However, it was previously recorded from Alexandria and Nile Delta without definite locality (El-Hennawy, 2002).

Table 6: Taxonomic list of arthropod fauna associated with spiders in investigated vegetable fields.

Class *	Order	Family	Species
Crustacea	Isopoda		
Insecta	Coleoptera	Anobiidae	<i>Ptinus</i> sp.
		Anthicidae	<i>Anthicus crinitus</i>
		Carabidae	<i>Dichirotrichus</i> sp. <i>Tachys lucasi</i>
		Chrysomelidae	<i>Chaetocenema latipennis</i> <i>Hypocassida subferruginea</i>
		Cicindelidae	<i>Cicindela melancholica</i>
		Curculionidae	<i>Sitona</i> sp. <i>Temnorhinus</i> sp.
		Dermestidae	<i>Attagenus pubescens</i>
		Elateridae	<i>Drasterius bimaculatus</i>
		Histeridae	<i>Saprinus</i> sp.
		Mycetophagidae	
		Nitidulidae	<i>Carpophilus</i> sp.
		Scarabaeidae	<i>Aphodius nanus</i> <i>Onthophagus aerarius</i> <i>Pentodon algerinum</i> <i>Psammodius porcicollis</i> <i>Rhyssalus goudoti</i> <i>Tropinota squalida</i>
		Tenebrionidae	<i>Gonocephalum</i> sp. <i>Scleron orientale</i> <i>Zophosis oculosis</i>
	Collembola		
	Dermaptera	Labiduridae	<i>Labidura riparia</i>
	Hemiptera	Cyrtidae	
		Lygaeidae	<i>Emblethis</i> sp. <i>Geocoris acuticeps</i> <i>Heterogaster</i> sp.
		Pentatomidae	<i>Eusarcocoris inconspicuus</i>
	Hymenoptera	Formicidae	<i>Camponotus aegyptiacus</i> <i>Cataglyphis niger</i> <i>Monomorium</i> sp. <i>Pheidole megace</i>
	Orthoptera	Gryllidae	<i>Acheta domestica</i>
			<i>Gryllus bimaculatus</i>
Chilopoda, Myriapoda	Geophilomorpha	Geophilidae	
	Lithobiomorpha	Lithobiidae	
	Scutigeromorpha	Scutigeridae	

* There are different taxonomic opinions in the classification of these higher taxa.

Spring season showed the occurrence of the highest number (25) of spider taxa, followed by summer season (23), while winter recorded 21 taxa and autumn recorded the lowest number of taxa (14). This shows the high diversity of spider taxa during spring and summer. Three taxa including *Lycosoides* sp., *Tegenaria* sp. of the family Agelenidae and unidentified individuals of Tetragnathidae occurred only in winter, while titanoecids, *Loxosceles* sp. and *Synaphosus* sp. were recorded in spring.

Spiders found in the different crops showed the high occurrence of 11 taxa comprising lycosid unidentified juveniles, *G₁*, *W. fidelis* and *P. injucunda*; unidentified individuals of Linyphiidae, *P. vegans* and *E. dentipalpis*; unidentified individuals of Theridiidae and its *S. erigoniformis*; *T. albini* of the family Philodromidae; and *Micaria* sp. of the family Gnaphosidae. This may be attributed to their tolerance to variance in weather conditions and other ecological, biotic and abiotic variables. On the other hand, *K. aulica* of the family Theridiidae, *Scytodes* sp. of the family Scytodidae and *Menemerus* sp. and *P. paykulli* of the family Salticidae were only collected in summer in few numbers.

Survey of other arthropod fauna

Concerning arthropod fauna other than spiders, members of ten orders of the three classes, or higher taxa, Crustacea, Insecta and Chilopoda (Myriapoda) were collected with association of spiders in pitfall traps. These arthropods were presented by orders Isopoda (Crustacea), Coleoptera, Collembola, Dermaptera, Hemiptera, Hymenoptera and Orthoptera (Insecta) and Geophilomorpha, Lithobiomorpha and Scutigleromorpha (Chilopoda, Myriapoda) (Table 6).

Surveyed orders included more than 22 families of which 33 genera and 23 species were identified. The most abundant species recorded during this study were: Collembola, *Acheta domestica* (Order Orthopetra), *Camponotus aegyptiacus*, *Cataglyphis niger*, *Monomorium* sp. and *Pheidole megace* (Order Hymenoptera), *Labidura riparia* (Order Dermaptera), *Anthicuc crinitus*, *Drasterius bimaculatus*, *Gonocephalum* sp. and *Zophosis oculosis* (Order Coleoptera).

In conclusion, this study is considered a primary investigation of the occurrence of spiders and other associated arthropods in legume and cucurbit crops in the southern part of Nile Delta. However, other studies are still needed to clarify the role of these arthropods as predators of agricultural pests.

List of identified spider species

<i>Erigone dentipalpis</i> (Wider, 1834)	<i>Prinerigone vagans</i> (Savigny, 1825)
<i>Gnathonarium dentatum</i> (Wider, 1834)	<i>Setaphis subtilis</i> (Simon, 1897)
<i>Hogna ferox</i> (Lucas, 1838)	<i>Steatoda erigoniformis</i> (O.P.-Cambridge, 1872)
<i>Kochiura aulica</i> (C.L.Koch, 1838)	
<i>Pardosa injucunda</i> (O.P.-Cambridge, 1876)	<i>Thanatus albini</i> (Audouin, 1825)
<i>Plexippus paykulli</i> (Audouin, 1825)	<i>Wadicosa fidelis</i> (O. P.-Cambridge, 1872)

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Spider populations associated with different types of cultivation and different vegetable crops in Fayoum Governorate (Egypt)

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Abstract

This is a study of the effects of 3 cultivation types and 10 agricultural vegetable crops on spider populations. It was carried out in Fayoum (Middle Egypt) by pitfall traps. Highest densities of spider individuals were in cabbage monoculture (52), and pepper/eggplant intercropping (45). The lowest densities of spiders were found in garlic crop rotation (11) and tomato monoculture (13).

Keywords: Spiders, Intercropping, Monoculture, Crop rotation, Fayoum, Egypt.

Introduction

Spiders play an important role as predators in regulating insect pests in the agricultural ecosystem. They are classified into about 40,000 species distributed all over the world in almost every kind of habitat. The population densities and species abundance of spider communities in agricultural fields can be as high as in natural ecosystems (Turnbull, 1973).

Crop diversity also leads to an availability of alternative prey, which may increase spider diversity as well as reducing territory size of spiders, leading to a stable population of spiders at high densities (Provencher & Vickery, 1988). To conserve and enhance spider populations, agricultural systems should be manipulated in ways beneficial to the needs of the spiders. The structural complexity of the environment is directly related to spider density and diversity. Highly varied habitats provide a greater array of microhabitats, microclimatic features, alternative food sources, retreat sites, and web attachment sites. All of which encourage colonization and establishment of spiders (Riechert & Lockley, 1984; Young & Edwards, 1990; and Rypstra *et al.*, 1999).

A strong relationship between spider density and habitat structure has been demonstrated by correlations and experimental manipulations. Measures that increase the structural complexity of the habitat, such as intercropping, mulching and conservation tillage, are known to enhance spider density and diversity (Rypstra *et al.*, 1999).

In Egypt, spiders represent a considerable ratio, 36.34%, of the total soil fauna, collected by pitfall traps, in different agroecosystems in Fayoum, Middle Egypt (Ghabbour & Mikhail, 1993), while their ratio is only 4.44% in the newly reclaimed desert ecosystem west of the Nile Delta (Hussein, 1993).

This work studies the effect of different types of cultivation, i.e. intercropping, monoculture and crop rotation, of different vegetable crops on the activity density and biodiversity of spiders in Fayoum (Middle Egypt).

Material and Methods

Study Area. The locality of the experiment was Sennouras village, Fayoum Governorate, during the period of May 15 until the end of October 2003. The study area consists of $\frac{1}{3}$ feddan (1 feddan = 4200m²) divided into five plots and cultivated with different types of cultivation.

Plot (1): Cultivated with tomato (*Lycopersicon esculentum*) intercropped with squash (*Cucumis cucurbita*), from May to August, while tomato continued alone, i.e. monoculture, until the 1st November.

Plot (2): Cultivated with tomato intercropped with pumpkin (*Cucurbita moschata*) from May to August, followed by tomato and squash until the 1st of November as crop rotation.

Plot (3): Cultivated with cowpea (*Vigna unguiculata*), monoculture, followed by garlic (*Allium sativum*) as crop rotation.

Plot (4): Cultivated with green pepper (*Capsicum frutescens*), intercropped with eggplant (*Solanum melongena*) from May to August followed by spinach (*Spinacia oleracea*) and radish (*Raphanus sativus*) as crop rotation.

Plot (5): Cultivated with cabbage (*Brassica capitata*) as monoculture.

Sampling method. The samples of spiders were collected from the study area by the pitfall trap method as described by Southwood & Henderson (2000). Four traps/week were regularly applied for each crop. Obtained spiders were preserved in 75% ethyl alcohol and classified to species level as much as possible. A list of identified spider species, alphabetically arranged, is presented after table (3) with authors and dates to avoid mentioning them inside the tables and text.

Frequency and Abundance values. The frequency values of the most abundant species were classified into three classes according to the system adopted by Weis Fough (1984). "Constant" species were considered as those found in more than 50% of samples, "accessory species" were those found in 25-50% of samples, and "accidental species" were those found in less than 25% of the samples. On the other hand, the classification of dominance, abundance, values was done according to Weigmann (1973) system (El-Shahawy and El-Basheer, 1992) in which the species were divided into five groups based on the values of dominance in the sample, i.e. percentage of individuals; Eudominant species (>30%), dominant (10-30%), subdominant (5-10%), resident (1-5%) and subresident species (<1%).

Results and Discussion

1- Effect of intercropping

Four families were recorded from the intercropping cultivation. The total number of obtained spiders was 28, 30, and 44 from the three plots of tomato/squash,

tomato/pumpkin and pepper/eggplant respectively (Table 1). The highest number of spiders was obtained in August. It was: 15, 16, and 15 from the intercropping tomato/squash, tomato/pumpkin and pepper/eggplant respectively.

Lycosidae was the predominant family of spiders with the ratios 89.29, 83.33 and 68.9% in intercropping tomato/squash, tomato/pumpkin and pepper/eggplant respectively (Table 4). It was considered a constant family according to the system adopted by Weis Fogh (1984) and it was eudominant family according to Weigmann's system (1973). Ghabbour *et al.* (1999) indicated that Lycosidae was the predominant family (79.06%) of spider fauna in different crops. In addition, Ahmed (2003) indicated that Lycosidae represented most of the spider population recording 83.77% with very high occurrence.

Linyphiidae was considered an accidental family and a resident in tomato intercropping squash and tomato/pumpkin but it was a dominant family in pepper/eggplant intercropping. Coll & Bottrell (1995) studied the effect of intercropping bean/maize cultivation to report that spiders of families Linyphiidae and Araneidae were more abundant in dicultures.

In this study, the number of spiders collected from the plot cultivated with pepper intercropping eggplant is more than other plots. Wallwork (1976) explained that spider populations are separated by different preferences for microclimatic conditions, although these preferences may vary within a species, during the reproductive period. In addition, soil texture may have an important influence on the distribution patterns of spiders that deposit their cocoons in the soil.

Table 1: Spider families, genera and species, affected by different types of intercropping vegetables.

Taxa	Tomato / Squash					Tomato / Pumpkin					Pepper / Eggplant				
	Sex and age structure				Tn	Sex and age structure				Tn	Sex and age structure				Tn
	♂	♀	Sa	J		♂	♀	Sa	J		♂	♀	Sa	J	
Linyphiidae *			1s♂		1			1s♂		1	1			2	3
<i>Erigone dentipalpis</i>												1			1
<i>Prinerigone vegans</i>			1s♀	1	2				1	1			1s♂	3	4
Lycosidae *	2			5	7				13	13				5	5
<i>Wadicosa fidelis</i>	5	4	2s♂, 3s♀	3	17	7			1	8	10	3	4s♂, 4s♀	2	23
Lycosidae (one genus)			1s♂		1	1	2	1s♀		4	2		1s♂		3
Philodromidae <i>Thanatus</i> sp.											1	1		1	3
<i>Thanatus albini</i>							1	1s♀	1	3					
Theridiidae *											1				1
<i>Kochiura aulica</i>											1				1
Total	7	4	8	9	28	8	3	3	16	30	16	5	10	13	44

* = Individuals only identified to family level; J = juvenile; Sa = subadult; Tn = total number.

2- Effect of monoculture

Seven families were recorded from the monoculture cultivation. The total number of obtained spiders was 29, 52, 13 from the three plots of kidney bean, cabbage and tomato respectively (Table 2).

Cabbage's microclimate was very important factor for the high population density of spiders. Vlijm & Kessler-Geschiere (1967) explained that microclimate seems to be an

important factor in determining distribution patterns. Some spider species, at least, show narrow tolerances of environmental temperature and relative humidity. However, these preferences may change with the seasons and with the completion of mating. In addition, Ghabbour *et al.* (1999) concluded that, the differences of number might be due to shade of plants and available humidity expressed as water requirements for each crop in addition to density of plants/acre. This directly affects abundance of spiders' prey and governs occurrence of birds and other spiders' natural enemies.

Lycosidae was the predominant family with the ratios 68.96, 84.62 and 69.23% in monoculture cultivation of kidney bean, cabbage and tomato respectively (Table 4). It was considered a constant and eudominant family. Dictynidae was dominant in kidney bean and Philodromidae was dominant in tomato monocultures. Both Linyphiidae and Miturgidae were resident in kidney bean and cabbage. Thomisidae was subdominant (7.69%) in monoculture tomato while it disappeared from kidney bean and cabbage. However, some vegetables positively affect the biodiversity and activity of some families and another type of vegetables has negative effects. The population density is dependant on the total number of pests that invested plants.

Table 2: Spider families, genera and species, affected by different types of monoculture vegetables.

Taxa	Kidney Bean					Cabbage					Tomato				
	Sex and age structure				Tn	Sex and age structure				Tn	Sex and age structure				Tn
	♂	♀	Sa	J		♂	♀	Sa	J		♂	♀	Sa	J	
Dictynidae *		2		3	5										
Linyphiidae *									1	1					
<i>Gnathonarium dentatum</i>		1			1										
Lycosidae *				4	4	2			8	10				3	3
<i>Wadicosa fidelis</i>	5	4	1s♂	1	11	12	9	2s♂	7	30	2	2			4
Lycosidae (one genus)	3	2			5	1	3			4	2				2
Miturgidae <i>Cheiracanthium</i> sp.	1				1				1	1					
<i>Cheiracanthium isiacum</i>											1				1
Philodromidae <i>Thanatus</i> sp.									1	1	1				1
<i>Thanatus albini</i>						2	1		1	4		1			1
Salticidae *									1	1					
Theridiidae *				1	1										
<i>Kochiura aulica</i>	1				1										
Thomisidae <i>Thomisus spinifer</i>											1				1
Total	10	9	1	9	29	17	13	2	20	52	7	3	0	3	13

* = Individuals only identified to family level; J = juvenile; Sa = subadult; Tn = total number.

3- Effect of crop rotation

Six families were recorded from the crop rotation cultivation. The total number of obtained spiders was 11, 19, and 14 from the three plots of garlic, radish/spinach and tomato/squash respectively (Table 3). The lowest number of individuals and diversity of spider species was found in the plot cultivated by garlic after cowpea, i.e. Plot 3. Crop rotation generally decreases the individual pest infestation, especially in garlic.

Lycosidae constituted a higher population than other families. This result is agreed with Ghallab *et al.* (In press) and Edwards & Lofty (1969) that crop rotation decreases species diversity to an even greater extent. Rizk *et al.* (2002) explained the

result that chemical composition of plants is of great importance in guiding the insect in the selection process. In addition, spiders, in this study, might be affected with volatile garlic deterrents.

Lycosidae was the predominant family with the ratios 63.64, 68.4 and 57.14% in crop rotation cultivation of garlic, radish/spinach and tomato/squash, respectively (Table 4). It was considered a constant eudominant family. Philodromidae was dominant in the three plots. Other dominant families were Theridiidae in garlic and Dictynidae in tomato/squash.

Table 3: Spider families, genera and species, affected by different types of crop rotation vegetables.

Taxa	Garlic					Radish / Spinach					Tomato / Squash				
	Sex and age structure				Tn	Sex and age structure				Tn	Sex and age structure				Tn
	♂	♀	Sa	J		♂	♀	Sa	J		♂	♀	Sa	J	
Dictynidae *									1	1	1	1			2
Linyphiidae <i>Prinerigone vegans</i>						1				1					
Lycosidae *				3	3				5	5				5	5
<i>Wadicosa fidelis</i>	2	1	1s♂		4	3	3	1s♂		7		2			2
Lycosidae (one genus)						1				1	1				1
Miturgidae <i>Cheiracanthium</i> sp.													1s♂		1
Philodromidae <i>Thanatus</i> sp.				1	1				3	3				3	3
<i>Thanatus albini</i>	1				1										
Theridiidae *				2	2										
<i>Kochiura aulica</i>						1				1					
Total	3	1	1	6	11	6	3	1	9	19	2	3	1	8	14

* = Individuals only identified to family level; J = juvenile; Sa = subadult; Tn = total number.

List of identified spider species

Erigone dentipalpis (Wider, 1834)

Cheiracanthium isiacum O.P.-Cambridge 1874

Gnathonarium dentatum (Wider, 1834)

Kochiura aulica (C.L.Koch, 1838)

Prinerigone vagans (Savigny, 1825)

Thanatus albini (Audouin, 1825)

Thomisus spinifer O.P.-Cambridge 1872

Wadicosa fidelis (O. P.-Cambridge, 1872)

Conclusion

This study indicated that the diversity of the spider fauna in a given site is often related to the structural diversity of the habitat. Indirectly, the surface vegetation affects spider population density and biodiversity, which is influenced by microclimate of the plant. Where growth dependent on a mosaic of microclimatic conditions is produced with shaded areas interspersed with more open exposed area. These variations in sun and shade have a marked effect on the horizontal distribution patterns of many pests affected directly on the growth rate of spiders.

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Table 4: Spider families, abundance and frequency in intercropping, monoculture, and crop rotation vegetables.

Family		Intercropping Vegetables						Monoculture Vegetables						Crop rotation Vegetables														
		Tomato + Squash			Tomato + Pumpkin			Pepper + Eggplant			Kidney Bean			Cabbage			Tomato			Garlic			Radish + Spinach			Tomato + Squash		
Frequency		Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance	Total	%	Abundance
Dictynidae	A	0	-	-	0	-	-	0	-	-	5	17.24	D	0	-	-	0	-	-	0	-	-	1	5.3	Sd	2	14.3	D
Linyphiidae	A	1	3.57	R	1	3.33	R	5	11.11	D	1	3.45	R	1	1.92	R	1	0	-	0	-	-	0	-	-	0	-	-
Lycosidae	C	25	89.29	Ed	25	83.33	Ed	31	68.9	Ed	20	68.96	Ed	44	84.62	Ed	9	69.23	Ed	7	63.64	Ed	13	68.4	Ed	8	57.14	Ed
Miturgidae	A	0	-	-	0	-	-	0	-	-	1	3.45	R	1	1.92	R	1	7.69	Sd	0	-	-	0	-	-	1	7.14	Sd
Philodromidae	A	2	7.17	Sd	1	3.33	R	6	13.33	D	0	-	-	5	9.62	Sd	2	15.38	D	2	18.18	D	4	21.1	D	3	21.4	D
Salticidae	A	0	-	-	0	-	-	2	4.44	R	0	-	-	1	1.92	R	0	-	-	0	-	-	1	5.3	Sd	0	-	-
Theridiidae	A	0	-	-	3	10.0	Sd	1	2.22	R	2	6.89	Sd	0	-	-	0	-	-	2	18.18	D	0	-	-	0	-	-
Thomisidae	A	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-	1	7.69	Sd	0	-	-	0	-	0	-	-	
Total		28			30			45			29			52			13			11			19			14		

Frequency: A = Accidental (found in < 25 % of the samples), C = Constant (found in > 50 % of the samples). [The same for all crops]

Abundance: R = Resident (1-5 %), Sd = Subdominant (5-10 %), D = Dominant (10-30 %), Ed = Eudominant (> 30 %).

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